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(71) Applicants
SAPAL, Societe Anonyme des Plieuses Automatiques,
44 av. du Tir Federal,
1024, Ecublens,
Switzerland

(72) Inventor
Ulrich Kramer

(74) Agents
Sommerville & Rushton,
89 St. Peters Street, St. Albans, Hertfordshire
AL1 3EN

(54) **A dosing arrangement for products with a liquid or pasty consistency**

(57) The present invention relates to a dosing arrangement for products with a liquid to pasty consistency. It comprises a feed arrangement 10 equipped with a tank 11 for the substance to be dosed. The dosing assembly is composed of a dosing chamber 21 and a dosing piston 22. The mechanical drive device 30 for the piston 22 has a pivoting lever 32 which brings about the reciprocating movement of the piston and a rack 54 acts on a toothed pinion 53 to bring about an alternating rotation of the piston through half a revolution. An adjustment mechanism 60 makes it possible to adjust the stroke of the piston by displacing an axis 33 which forms the pivot point of the lever 32. On each operating cycle the piston carries out an alternating axial displacement and a rotation through half a revolution around its longitudinal axis.

FIG. 1

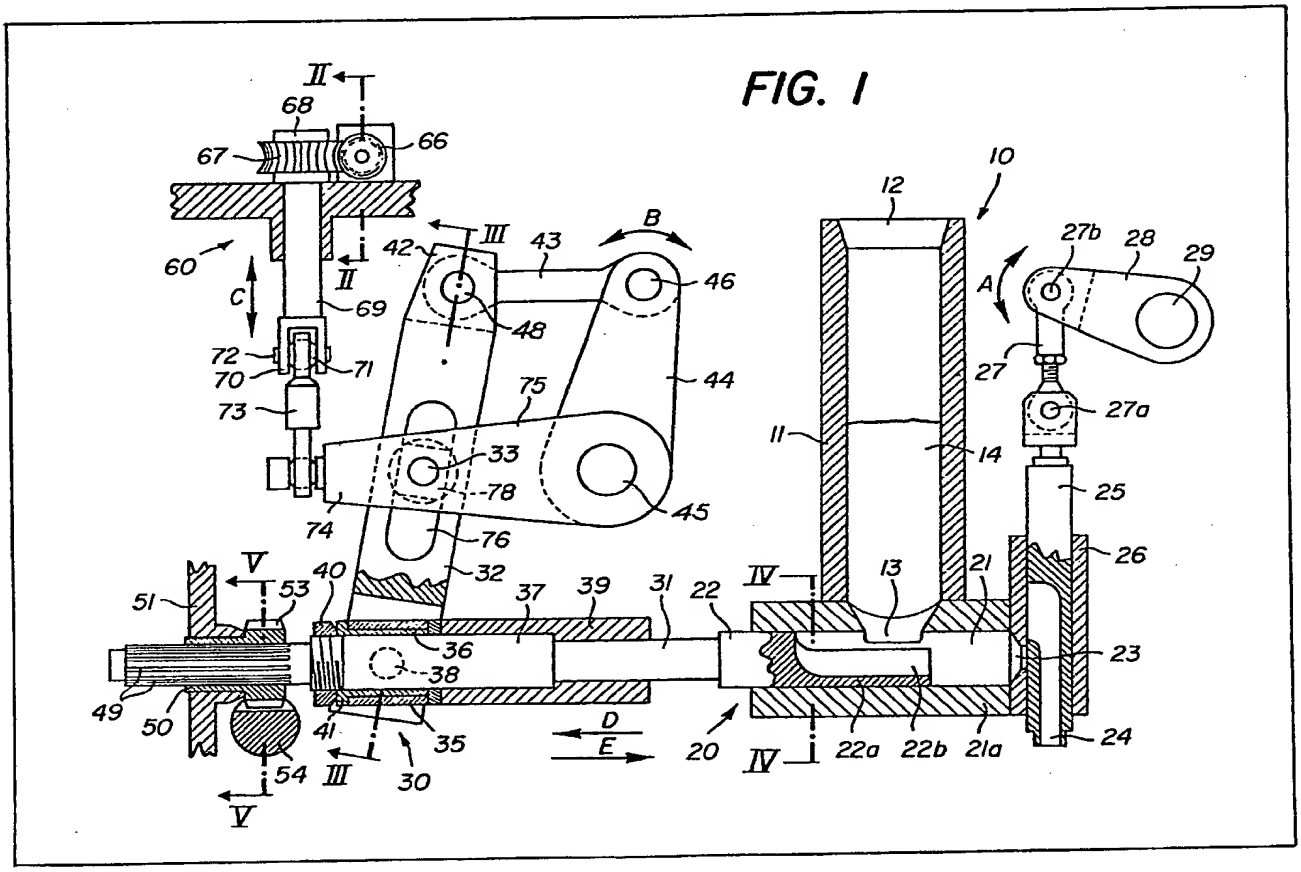

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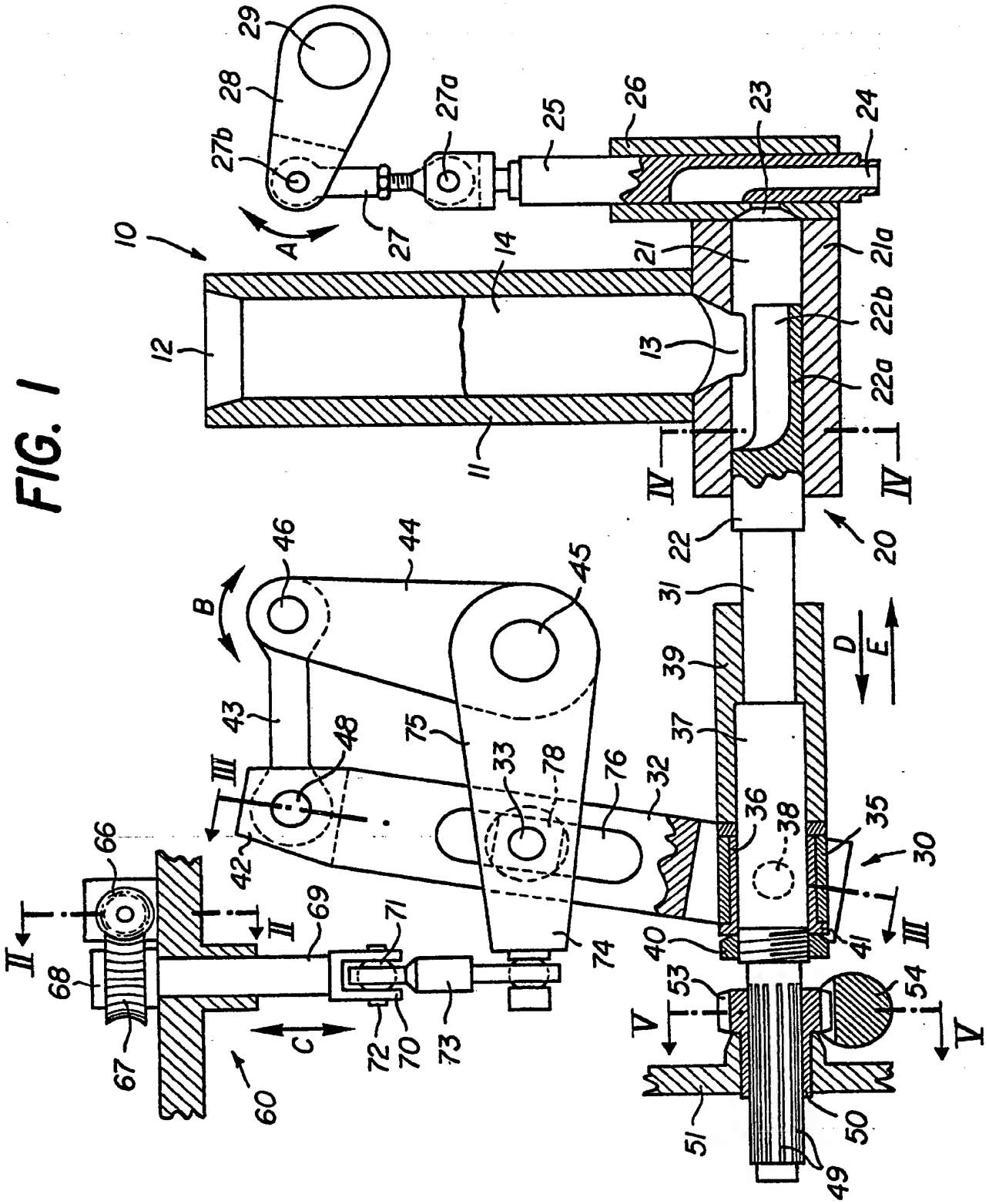
FIG. 1



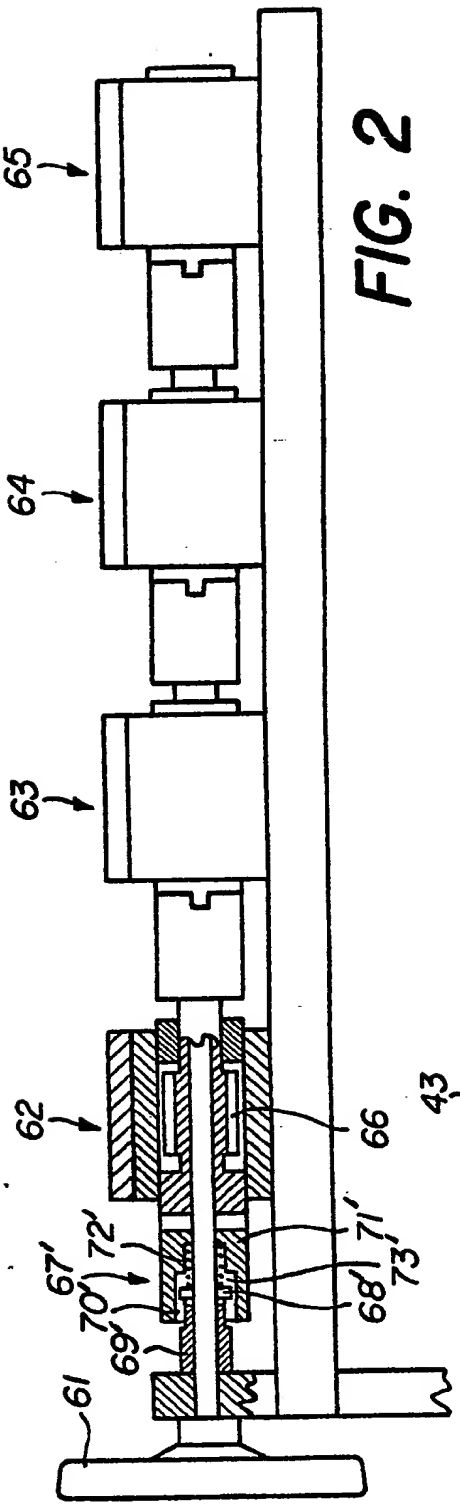


FIG. 2

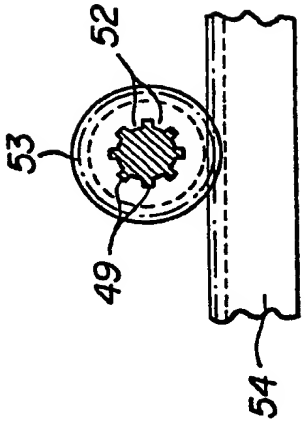


FIG. 5

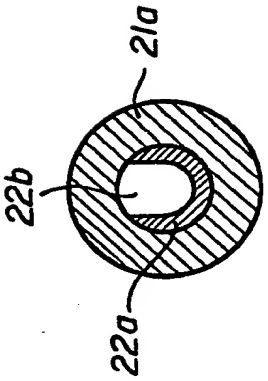


FIG. 4

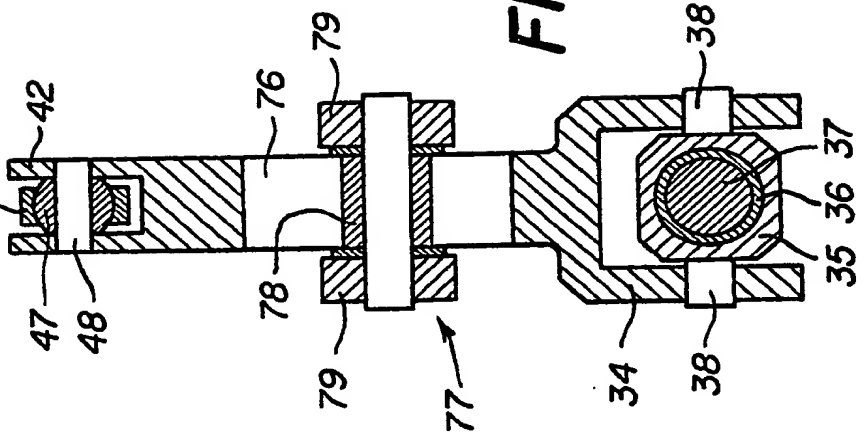


FIG. 3

SPECIFICATION

A dosing arrangement for products with a liquid to pasty consistency

The present invention relates to a dosing arrangement for products with a liquid to pasty consistency, of the kind comprising a feed arrangement for the product to be dosed, at least one dosing chamber connected to this arrangement, a dosing piston accommodated in this chamber and a drive mechanism for this piston.

At the present time dosing machines for products with a liquid to pasty consistency, and particularly those which are used for preparing portions of processed cheese, have a dosing piston which carries out a reciprocating movement through a dosing chamber. The volume of processed cheese corresponding to one portion is equal to the product of the plane surface of the piston and its stroke.

At the present time these machines have an additional arrangement for filling the chamber, equipped with locks or non-return valves to prevent the substance which is to be dosed from being forced back into the tank during dosing. The known machines are mostly multi-line machines on which individual adjustment is not provided for each line. However, the lines are frequently subject to different degrees of wear, so that repair or adjustment of a single line necessitates stopping the whole machine. A stop like this constitutes an interruption in production and thus a loss to the manufacturer.

An object of the present invention is to remedy the above-mentioned drawbacks.

According to this invention a dosing arrangement of the kind referred to above is characterised in that the piston and the dosing chamber are cylindrical, and in that the drive mechanism for the piston is designed so that, during each cycle, the piston carries out a reciprocating translation along its longitudinal axis and an alternating rotation through half a revolution around this axis.

Thus, the invention provides a dosing arrangement in which the piston advantageously replaces the supplementary devices which ensure the filling of the dosing chamber and the closing of the latter when the substance is forced back at the end of each dosing cycle. Furthermore, the drive mechanism for the dosing piston can be designed so that the stroke of the piston may be modified continuously during operation of the machine, that is to say, the volume of substance dosed by the machine may be modified during operation, and this control may be effected independently for each dosing line in the machine, without jolting, i.e. without moving parts coming to rest against alternative fixed stops. These features afford obvious advantages since they enable wasteful time losses to be avoided, and consequently reduce production costs. Furthermore, cleaning is certainly simplified when the dosing machine has fewer parts, which would be the case with the dosing arrangement here, since the valve/piston unit is replaced by a single piston.

The particular shape of the piston and its rotation during each cycle allow it to fulfil the usual roles of sucking the substance which is to be dosed into a dosing chamber and of forcing it out of this chamber towards a pouring device of some kind, but also that of a non-return valve, since after the sucking-in phase the piston turns on its axis and closes the inlet orifice for the substance, this orifice being provided so that the dosing chamber can communicate with the feed arrangement.

Modification of the volume dosed during each cycle while the machine is operating is accomplished by modification of the stroke of the dosing piston, for example, by means of a micrometric screw acting on the position of the pivot point of an oscillating lever connected to the piston rod to communicate a reciprocating movement to it. Since the volume of substance dosed is proportional to the stroke of the piston, any variation of this stroke obviously brings about a proportional variation in the volume of substance delivered during each cycle of the machine.

The present invention will be readily understood and further features made apparent from the following description of an embodiment of one dosing arrangement according to the invention, taken in conjunction with the accompanying drawings in which:—

Figure 1 is a schematic view of the functional elements of the dosing arrangement.

Figure 2 shows a partial enlarged section along the line II—II in Figure 1.

Figure 3 is a sectiona through part of the arrangement shown in Figure 1, along the line III—III.

Figure 4 is a transverse section through the piston, along the line IV—IV in Figure 1.

Figure 5 is a section along the line V—V through the arrangement shown in Figure 1.

Referring to Figure 1, the arrangement according to the invention is basically composed of a feed arrangement 10, a dosing assembly 20, a mechanical drive device 30 for the piston, and an arrangement 60 for adjusting the stroke of the piston. In the embodiment described and shown the feed arrangement 10 is composed in a non-limitative manner of a vertical tank 11 provided in its upper part with a filling orifice 12 and at its lower end with an emptying opening 13 which allows the inside of the tank 11 to communicate with the dosing chamber 21 in order to allow the substance 14 which is to be dosed out and is contained in the tank 11 to pass into the dosing chamber 21. Naturally, th tank 11 could be replaced by another feed arrangement known per se. The dosing assembly 20 is composed basically of the dosing chamb r 21 and th dosing piston 22. The dosing chamber 21 is cylindrical in shape and has at its front end (on the right in the Figure) a delivery hole 23 designed to communicate with a duct 24 provided inside a

part 25 which can be displaced axially inside a guide element 26, one wall of which forms the front wall of th dosing chamber 21. The movable part 25 is integral with a link-rod 27 of a kind known per se and the two ends 27a and 27b of which are articulated respectively on the end section of the part 25 and on a lever 28 integral with a pivotable axis 29. In Figure 1 the lever 28 is shown in its upper position in which the mouth of the duct 24 is not in communication with the delivery hole 23 of the dosing chamber 21. When th lever 28 has swung along the arrow A into its lower position (not shown) the part 25 is moved towards its lower position so that the mouth of the duct 24 is located opposite to the delivery hole 23 of the dosing chamber 21, to allow delivery of a predetermined volume of the substance which is to be dosed.

The dosing piston 22 is composed of a cylindrical block having an external diameter which corresponds substantially to the internal diameter of the dosing chamber 21 so that it can slide freely inside this chamber. The dosing piston 22 has a central cavity 22b, the shape of which is shown in the sectional view in Figure 4. This view shows in transverse section the lateral walls 21a of the dosing chamber 21, the U-shaped lateral walls 22a of the dosing piston 22 and the central cavity 22b. This cavity extends over part of the length of the dosing piston in such a way that the lateral walls which define this cavity are in the form of a U.

The mechanical drive arrangement 30 for the dosing piston 22 acts on a piston rod 31 which is integral with the piston and is disposed in axial extension thereof. On each operating cycle of the machine the piston undergoes a reciprocating movement which is transmitted to the piston rod 31 via a lever 32 which is pivotable around an axis 33, the position of which can be adjusted. Figure 3 is a sectional view showing the shape and disposition of the lever 32. The lower end 34 of this lever, in the shape of a fork, is connected to a block 35 with a square section inside which an annular part 36 is mounted, surrounding a large-diameter section 37 of the piston rod 31. Two lateral pins 38 enable the block 35 with the square section to be connected to the lower, fork-shaped end 34 of the lever 32. The piston rod 31 is mounted by means of the large-diameter section 37 in the annular part 36 which is itself integral with the square-section block 35, and is accordingly pivotably mounted at the lower end 34 of the lever 32. To hold these various elements in place the piston rod is partly surrounded by a fix d sleeve 39 and comprises an annular stop 40 screwed down against a shoulder 41 on the annular part 36.

The other end 42 is also in the shape of a fork and is connected via a push-rod 43 to a control lever 44 mounted rigidly, for exampl , by means of pins, on a pivoting axle 45. One of the ends of the push-rod 43 is mounted so that it can pivot around a pin 46 which is integral with the fre end of the control lever 44 and the other end of th push-rod 43 is mounted, for example, by means of a ball-joint 47 and a pin 48, on the fork-shaped end 42 of the lever 32.

During a normal operating cycle of the machine the pivoting axle 45 entrains the control lever 44 in the direction of the arrow B. This movement is transmitted by the push-rod 43 to the upper end 42 of the lever 32, which pivots around the fixed axis 33 and causes the reciprocating movement of the dosing piston 22.

At its free end the rod of the piston 22 has a certain number of peripheral splines 49 and bears a sleeve 50 which is held in its axial position by a fixed stop 51. In this embodiment, as shown in section in Figure 5, the sleeve 50 has grooves 52 on its inside surface, the profile of these grooves being adapted to that of the splines 49 so that the splined end of the piston rod 31 is able to slide freely through the central opening in the sleeve 50. The splines 49 and the grooves 52 co-act to form the guiding elements to guide the piston rod during its reciprocating movement and the locking elements to prevent relative rotation of the sleeve and the rod. On its front end (on the right in Figure 1) the sleeve has a protuberance which forms a toothed wheel 53 with its teeth parallel to the axis of the piston rod and which is designed to mesh with the teeth of a rack 54 disposed perpendicularly to the axis of the piston rod.

The rack 54 is connected to a mechanism (not shown) which is able to bring about its displacement in a direction perpendicular to the plane of Figure 1, this movement being transmitted to the toothed wheel 53 on the sleeve 50 and finally to the piston rod 31, to cause an alternating rotation of the dosing piston 22 through half a revolution.

In this embodiment, the rack acts on a toothed wheel which is held in a fixed position relative to the piston rod, which allows the two movements of translation and rotation to be varied on account of wear on the mechanical parts. However, it would be equally conceivable to equip the end of the piston rod with splines or teeth with an appropriate shape for them to engage directly in the teeth on the rack 54.

As shown in Figure 1 and also in section in Figure 2, the arrangement 60 for adjusting the stroke of the piston comprises a manual control hand-wheel 61 which acts synchronously on four adjustment mechanisms 62, 63, 64 and 65 associated with four dosing lines disposed in parallel. Naturally, it would be conceivable to provide a separate control for each of the lines but in practice this has not proved useful. The hand-wheel 61 is integral with a micrometric screw 66 which acts on a toothed pinion 67 having on its inside surface a micrometric screw acting on the head 68 of a rod 69 which is axially movable in the direction of the arrow C (see Figure 1). The lower end of the rod 69 comprises a fork 70 which makes it possible to retain, by means of a system of ball-joint 71 and pins 72, a push-rod 73, the lower end of which is mounted at the free end 74 of a lever 75 mounted loosely on the pivoting axis

45. The lever 32 has an oblong slot 76 with its longitudinal sides parallel to the lever axis. The pivoting axle 33 is mounted on a carriage 77 (see Figure 3) designed to slide in the slot 76. This carriage is made up basically of a square projecting part 78, the side of which is substantially the same as the width of the slot 76 so that it can slide in this slot resting on the longitudinal sides. This projecting part is retained in the slot by two cheeks 79 mounted on either side of the projecting part 78.

These elements make it possible to displace the free end 74 of the lever 75 and consequently to displace the position of the axis 33 which forms the pivot point of the lever 32, thus allowing the stroke of the piston 22 to be modified during operation.

After a normal operating cycle the duct 24 is initially located in the raised position, as shown in Figure 1. The piston is then drawn back, which results in the substance 14 contained in the tank 11 being sucked in. The displacement of the rack 54 causes the dosing piston 22 to rotate through half a revolution, which results in closure of the emptying hole 13 disposed at the bottom of the tank 11. At this moment the part 25 should be brought back into its lower position to put the mouth of the duct 24 in communication with the delivery hole 23. The piston then moves in the direction of the arrow E, which has the effect of forcing a predetermined volume of the substance to be dosed through the hole 23 and the duct 24. After raising the part 25, which closes the delivery hole 23, the machine is ready for a new dosing cycle.

Preferably, the machine comprises a plurality of lines, preferably four, as shown in Figure 2. To allow the piston stroke to be adjusted independently line by line, each line has an individual arrangement for the piston stroke, equipped with a mechanism which can link together all the four individual arrangements for combined adjustment or can uncouple them for individual adjustment.

As shown in Figure 2, this mechanism is composed of a dog clutch 67', that is, two parts with complementary shaping which can be joined together in specific position. A cross bar 68', which is fixed transversely across the end of a shaft 69', is accommodated in a longitudinal slot 70' in a hollow shaft 71'.

A spring 72' holds the crossbar 68' in the slot 70'. When the wheel 61 is pushed, the crossbar enters a widened zone 73', which forms a continuation of the slot 70', and can be turned freely relative to the hollow shaft 71'. Each dog clutch mechanism has similar elements, so that each line can be individually adjusted.

CLAIMS

1. A dosing arrangement for products with a liquid to pasty consistency, comprising a feed arrangement for the product to be dosed, at least one dosing chamber connected to this arrangement, a dosing piston accommodated in this chamber and a drive mechanism for this piston, characterised in that the piston and the dosing chamber are cylindrical, and in that the drive mechanism for the piston is designed so that, during each cycle, the piston carries out a reciprocating translation along its longitudinal axis and an alternating rotation through half a revolution around this axis.

2. An arrangement according to Claim 1, characterised in that the piston has an external diameter which is substantially equal to the internal diameter of the dosing chamber and comprises a dosing cavity formed by a recess extending axially over part of the length of the piston and defined by lateral walls having an at least approximately U-shaped transverse section.

3. An arrangement according to Claim 1, characterised in that it comprises a rod which is integral with the piston and is disposed in axial extension thereof, this rod comprising a toothed section extending over part of its length and provided with peripheral teeth parallel to its axis, and in that the drive mechanism for the piston comprises a toothed rack which is substantially perpendicular to the piston rod and is designed so that its teeth mesh with the teeth on the toothed section of the piston rod, the said rack being coupled to a drive device which is capable of bringing about axial displacement of the rack in order to cause the piston rod to rotate correspondingly.

4. An arrangement according to Claim 3, characterised in that the toothed section of the piston rod comprises a sliding sleeve disposed co-axially around the piston rod, this sleeve being provided over part of its length with peripheral teeth which mesh with the teeth on the rack and comprising guide elements to allow the sleeve to slide axially relative to the piston rod and locking elements to prevent the sleeve from rotating relative to the piston rod.

5. An arrangement according to Claim 4, characterised in that, over a part of its length which is at least equal to its stroke and is adjacent to the peripherally toothed sleeve, the piston rod comprises at least one peripheral rib parallel with its axis and having a profile corresponding to that of a longitudinal groove provided in the inside surface of the sleeve, this peripheral rib being engaged in this groove and these two elements forming the guiding and locking elements intended to allow the rod to be displaced axially relative to the sleeve and to prevent their relative rotation, the arrangement comprising at least one stop designed to hold the sleeve in a fixed axial position.

6. An arrangement according to Claim 4, characterised in that the sle v has a straight toothed pinion with external peripheral te th d signed to mesh with the movable rack substantially perpendicular to the axis of the rod, and in that the sleeve has grooves on its inside surface, these grooves having a shape and dim nsions which ar complementary to the splines on the piston rod so that the piston rod

may slide freely through the sleeve which is held in the axial position by at least one fixed stop, and so that the sleeve may rotate around its axis when its toothed pinion is entrained by the rack, the splines and grooves on the sleeve and the piston rod forming the guiding and locking elements for the sleeve and for the piston rod.

7. An arrangement according to Claim 3, characterised in that the piston rod is pivotably connected to one end of a piston control lever which can pivot around a fixed point the position of which can be varied, the other end of this lever being connected to a movable member designed to cause the lever to pivot alternately in one or other direction around the said positionally variable fixed point, this fixed point being limited by a sliding element which can take up at least two specific positions between the ends of this lever.

8. An arrangement according to Claim 7, characterised in that the sliding element is formed by a carriage which can pivot around an axis and is mounted in an oblong slot provided in the said lever between its ends and is able to slide in this slot, resting against its lateral sides.

9. An arrangement according to Claim 8, characterised in that the carriage has a projecting part with a substantially square shape which can pivot around an axis which is integral with an adjustment lever which has one end mounted so that it can pivot around a fixed axis and the other end connected to a member for controlling the piston stroke manually, the said substantially square part being engaged in the oblong slot provided in the lever, this slot having a width substantially equal to the sides of the square so that the projecting part can slide in the slot resting against the lateral sides thereof, and the said manual control member being connected to the adjustment lever via a rigid mechanical connecting element.

10. An arrangement according to Claim 9, characterised in that the member for manually controlling the piston stroke comprises a micrometric screw designed to bring about the axial displacement of the said mechanical connecting element connected to the movable end of the adjustment lever so as to bring about the displacement of the pivot point of the piston control lever.

11. An arrangement according to Claim 1, comprising a plurality of individual dosing lines, each of which has a dosing piston and a drive mechanism for this piston, characterised in that each line has an individual arrangement for adjusting the end of the piston stroke, each of these various arrangements having a mechanism to couple them together in order to allow combined adjustment of all the lines, and to disconnect them so as to make individual adjustment possible line by line.

12. A dosing arrangement constructed and adapted for use substantially as hereinbefore described, and as shown in the accompanying drawings.

13. A dosing machine having a dosing arrangement according to any one of the preceding claims.

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